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AUTHOR Frank, K.W.
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ABSTRACT

Beginning with the 1980-81 school year, the Navajo Mission/Academy implemented a new secondary school mathematics curriculum, Unified Mathematics, based on New York State's "Three-Year Sequence for High School Mathematics." The comprehensive package meets the school's 3-year mathematics graduation requirement and provides preparation for college-bound students. Each student receives a copy of open-ended learning goals (examples are attached), allowing creation of furthur and alternative goals, at the beginning of each unit and a list of units to be covered for the year. Each instructional unit contains teaching goals and behavioral learning objectives designed to be completed in 3 to 4 weeks. Many of the units are repeated throughout the 3 years, each time in a more advanced manner. Thus algebra, geometry, and trigonometry, normally segmented into year-long pieces, become blended and unified with topics such as logic, probability, and computer programming. Curriculum features integration of Navajo cultural background in geometrical design in a pioneering approach to teaching geometry. Activities in drawing and construction invoke students' cultural background in craft work, drawing, and design. Students investigate not only applications of mathematics in careers and the necessity of studying various mathematical topics for college preparation, but also lives of people who have made significant contributions to mathematics. (ERB)

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UNIFIED MATHEMATICS CURRICULUM
Scope, Sequence, and Goals

K.W. Frank, Navajo Mission/Academy
Farmington, New Mexico 1982

RC 013405

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U N I F I E D

M A T H E M A T I C S

SCOPE, SEQUENCE, AND GOALS

FOR THE THREE-YEAR CURRICULUM

OF THE NAVAJO MISSION/ACADEMY,

FARMINGTON, NM

K. W. Frank
Farmington, NM
June, 1982

Beginning with the 1980-81 school year, the Navajo Mission/Academy implemented a new mathematics curriculum: Unified Mathematics. Based originally on the new, integrated, secondary school mathematics curriculum of New York State*, Unified Mathematics weaves into one three-year fabric a range of mathematics topics. The result is a comprehensive package which meets the Mission/Academy's three-year mathematics graduation requirement; and which provides sound preparation for college-bound students.

All first-year students enroll in Unified Mathematics 1. Those whose backgrounds warrant it will be accelerated. Those with insufficient backgrounds may take a remediation course entitled Unified Mathematics Preparation. Students who complete two years of high school mathematics may opt out of the Unified Mathematics curriculum and take a Business/Consumer mathematics course. Those who have completed Unified Mathematics 3 may take a fourth-year pre-calculus course.

Based on the 1980-81 and the 1981-82 school year experiences, and on the nature of the school's student body, the New York curriculum has been extensively modified to produce the materials found within. In addition, the curriculum features integration of the Navajo cultural background in geometrical design in a pioneering approach to teaching geometry.

The main textual resource for this curriculum is Mathematics: A Topical Approach (Bumby and Klutch), published by Merrill, which has been written for the New York curriculum.

* Three-Year Sequence for High School Mathematics, The University of the State of New York, The State Education Department, Bureau of General Education Curriculum Development, Albany, New York, 1980.

Features of Interest in the Curriculum

Unified Mathematics at the Navajo Mission/Academy is organized firstly into three separate years of content, meant to be taken consecutively; and secondly into instructional units within each year. Each of the instructional units is designed to last about three to four weeks, so that ten or eleven such units complete a year's work. Each of the units outlined in this curriculum contains teaching goals and behavioral learning objectives. A separate booklet of teaching notes with worksheets, and a separate booklet of tests, have also been prepared to accompany these unit outlines.

Each unit covers a basic topic such as "Equations" or "Angles", and many of the units are repeated throughout the three years, each time in a more advanced manner. In this way algebra, geometry, and trigonometry, normally segmented into year-long pieces, become blended and unified with topics such as logic, probability, and computer programming. Students appreciate the variety and range of such an approach compared, for instance, to being "stuck" in Algebra for a whole year.

Some topics traditionally taught in the first three years of U.S. high school do not appear in this curriculum--for example, Conic Sections; Double Angle Formulas; or the Binomial Theorem. What is included in their place will serve as a sound mathematical background for the college-bound student, whether or not that student takes the fourth-year pre-calculus course at our school.

One very large departure from traditional U.S. high school geometry in this curriculum is the adoption of transformation geometry instead of Euclidean geometry. This alternative was selected in view of the cultural background of our Navajo students in geometric design. The intuitive grasp our students show of spatial perception and plane symmetry serves as a foundation on which to develop formal geometrical learning. Along with this emphasis goes considerable activity in drawing and construction, further invoking our students' cultural background in craft work, drawing, and design.

We have not discarded the attention given to formal deductive logic in the traditional approach to geometry. Students do study logic as a topic in itself in each of the first two years of this syllabus. In the second year, the idea of proof evolves from explanations of cryptarithm puzzles. That is, the students are asked to solve simple cryptarithms and present their answers in two-column proof format. The advantages of this approach are that first, the process does not rely on the sophisticated use of English as do traditional proofs in deductive logic. This makes the logic more accessible to our bilingual/bicultural students. Second, students have to puzzle out what is to be proven; since it is not obvious, the proof assumes greater importance.

One of the emphases of the entire Mission/Academy program is career education and orientation toward success in college. In their mathematics work, students investigate not only the applications of mathematics in careers and the necessity of studying various mathematical topics for college preparation, but also the lives of people who have made significant contributions to mathematics. Our students should discover something about these people as personalities who happened to be engaged in the endeavor of mathematics.

When the mathematics classes contain small numbers of students, the instructor can provide attention to individual student needs. In particular, the teacher must address those few students who can and ought to progress faster than the others. Exta work, and work assigned well in advance of the due date, can be given to these students. The teaching notes written for this curriculum indicate areas for more advanced work. The textbook contains a variety of extra and challenging material.

The text serves as the core of teaching and learning sources, but an assortment of other sources and worksheets are used throughout. These are indicated in the teaching notes. Often a puzzle or other amusement is a welcome substitute for necessary drill problems. The textbook does contain a superabundance of material, some of which is outside of the scope of this curriculum, but the teacher is expected to "cover the curriculum" and not to "cover the textbook".

Each student has been receiving a copy of the learning goals at the beginning of each unit as well as a copy of the list of units to be covered for the year. The learning goals are unfinished, or open-ended, which allows for student and teacher creation of further and alternative goals.

Some serious support for the major points of our curriculum can be found in the following articles from The Mathematics Teacher (published by the National Council of Teachers of Mathematics).

Usiskin, Zalman. "What Should Not Be in the Algebra and Geometry Curricula of Average College-Bound Students" Vol. 73, n. 6, Sept. 1980, pp. 413-23.

Hoffer, Alan. "Geometry Is More Than Proof" Vo. 74, n. 1, Jan. 1981, pp. 11-18.

UNIFIED MATHEMATICS — YEAR ONE

Units and order of presentation	Corresponding Chapter, MATA*, Book 1
A. Logic	1
B. Rational Numbers	2
C. Equations and Inequations	3 & 4
D. Angles	5
E. Ratio	6
F. Coordinates	14
G. Transformations	15
H. Radicals	7
I. Measurement	8 & 9
J. Polynomials	10

Optional units for future consideration or for advanced students:

Factoring (Ch. 11)
Probability (Ch. 12)
Programming (Ch. 13)

* MATA is the abbreviation for Mathematics: A Topical Approach, the text for this curriculum.

UNIFIED MATH 1

UNIT ON LOGIC

The goals of this unit are for you to:	You know you're making progress when you can:
1. learn more about logical sentence structure and classification;	1.a. classify statements people make as true, false, open, or opinion; b. negate both true and false statements; c. form your own conjunctions, disjunctions, conditionals, and bi-conditionals; d. translate English sentences into logic symbols, and vice-versa; e. make truth tables for compound sentences; f. form the converse, inverse, and contrapositive of a conditional sentence; g.
2. appreciate further the role of logic in daily life;	2.a. locate and report on politicians' or advertisers' conditional statements and test their truth values, as well as the truth values of the converses and inverses; b. analyze and design simple electronic logic circuits; c. describe to a friend the careers which depend everyday on logical thought; d.
3.	3.

The goals of this unit are for you to:	You know you're making progress when you can:
1. develop greater arithmetic skill with signed numbers;	1.a. use signed numbers to solve arithmetic puzzles and magic squares; b. successfully play a signed number classroom game; c. evaluate algebraic expressions after numerical substitutions; d. translate English expressions into algebraic expressions; e. explain to a friend what Please Excuse My Dear Aunt Sally means; f. show how "Pick a Number" tricks work; g.
2. learn more about the structure of the rational numbers;	2.a. locate any rational number on the number line; b. explain the use of absolute value in doing signed number arithmetic for a friend; c.
3. appreciate further the role of signed numbers in everyday life;	3.a. report on three everyday situations involving signed numbers to show direction or amount; b. describe to a friend three careers that depend everyday on the use of signed numbers; c.
4.	4.

The goals of this unit are for you to:	You know you're making progress when you can:
1. develop your skill in solving linear equations and inequations in one variable;	1.a. make your own arithmetic identities starting from given numbers; b. solve equations and inequations by the "undoing" method; c. check out the truth value of any solution set you find; d. graph solution sets on the number line; e. solve cross-number puzzles based on linear equations; f. translate English sentences into equations and inequations; g. locate errors in other people's solutions; h.
2. develop greater appreciation of the role of algebra in' people's lives;	2.a. ask scientists and/or engineers sensible questions about their use of algebra; b. report and ask sensible questions about some famous people in algebra history such as Diophantus, Recorde, Vieta, al-Khowarizmi, Harriot, and Leibniz; c. use forensic medicine formulas to calculate the lengths of bones in your body; d.
3.	3.

UNIT ON ANGLES

The goals of this unit are for you to:	You know you're making progress when you can:
1. learn more about points, lines, and planes;	1.a. point out parallel lines in the construction of a room and in drawings of shapes; b. calculate the perimeter of polygons; c. count vertices, faces, and edges in drawings of polyhedra; d.
2. develop skill in measuring and drawing angles;	2.a. use a protractor to measure or draw any angle and its bisector; b. name adjacent angles correctly using three letters; c. identify corresponding, alternate, right, acute, obtuse, and vertical angles in Navajo rug patterns; d.
3. learn more about angles in polygons;	3.a. calculate the measures of angles from information given in rough sketches; b. identify for a friend some different types of triangles and names of polygons up to 10 sides; c.
4.	4.

The goals of this unit are for you to:	You know you're making progress when you can:
1. develop skill in handling percent as a ratio;	1.a. convert between percent and ratios; b. measure various body lengths and form percents and ratios from the data; c. figure various sports statistics as percents and ratios; d. calculate discount prices; e. increase or decrease a recipe; f.
2. apply your skills to similar geometric shapes;	2.a. explain to a friend what makes two shapes similar; b. calculate corresponding lengths in similar geometric shapes; c. calculate actual distances from a map and its scale factor; d.
3.	3.

UNIT ON COORDINATES

The goals of this unit are for you to:

1. develop your skill in graphing points on the coordinate plane;

2. learn about graphing linear equations in two variables;

3.

You know you're making progress when you can:

1.a. recall the names of the various parts of the coordinate plane;
   b. plot points to form various shapes, pictures, and diagrams;
   c. name the x- and y-intercepts of straight lines;
   d.

2.a. name the slope and y-intercept of a straight line from its diagram or from its equation;
   b. draw the graph of a straight line, given its equation, by means of a table of values, or by the slope-intercept method;
   c. graph lines which are parallel to the axes;
   d. solve linear systems by locating where two lines cross;
   e.

3.

UNIFIED MATH 1

UNIT ON TRANSFORMATIONS

The goals of this unit are for you to:	You know you're making progress when you can:
1. develop skill in constructing transformation images;	1.a. construct reflections, rotations, translations, and dilations of points and shapes on plain paper and on graph paper using a ruler, compass, and protractor; b.
2. learn more about symmetry elements;	2.a. find and describe rotational and mirror symmetry in magazine pictures, Navajo rug designs, and so forth; b. form and draw some Navajo plane string figures, and locate their lines of mirror symmetry; c. create a 15x15 square grid for a professionl crossword puzzle; d. create a Navajo rug design which has mirror symmetry; e.
3.	3.

UNIFIED MATH 1

UNIT ON RADICALS

The goals for this unit are for you to:	You know you're making progress when you can:
1. develop skill in handling irrational numbers and radicals;	1.a. round off numbers to any desired decimal place; b. approximate square roots by using a square root table or a calculator; c. locate any irrational number on the number line; d. simplify radical square roots using multiplication factors; e. add and subtract radical expressions; f. use bar notation correctly for repeating decimals; g.
2. learn more about the Pythagorean Theorem	2.a. estimate and then calculate distances on graph paper; b. calculate distances from information given in diagrams of right triangles; c.
3. apply your skills with the Pythagorean Theorem to distances outside the classroom	3.a. calculate an out-of-the-classroom distance such as the outside diagonal length of the school gym; b. explain which people need to know the results of Pythagorean calculations in their work; c.
4.	4.

UNIT ON MEASUREMENT

The goals of this unit are for you to:	You know you're making progress when you can:
1. develop your skill in using metric units;	1.a. convert between various metric units of length, mass, and volume; b. estimate distances, areas, volumes, and masses of everyday items in metric units; c.
2. develop your skill in calculating areas and volumes of simple shapes;	2.a. calculate the areas of triangles, parallelograms, and circles; b. calculate the volumes of cuboids (boxes) and cylinders (cans); c.
3. understand π as a ratio;	3.a. calculate an experimental value of π from a circular object; b. estimate circumferences and areas of circles, given their diameters; c.
4.	4.

UNIFIED MATH 1

UNIT ON POLYNOMIALS

The goals of this unit are for you to:	You know you're making progress when you can:
1. develop your skill in working with powers of numbers;	1.a. calculate simple integral powers of simple rational numbers; b. express any very large or very small numbers in scientific notation, and vice-versa; c. successfully use the basic laws of exponents in handling algebraic expressions; d.
2. develop an appreciation of the use of exponents in technical work;	2.a. locate three examples of the use of scientific notation in science magazines; b. report on the sizes of a googol; a googolplex; a mole; a nanosecond; or a megaton; c. report on the people likely to be using the above numbers in their work; d. invent a very large or very small number of your own, together with your own name for it; e.
3.develop your skill in handling polynomials;	3.a. add and subtract like terms; b. multiply and divide monomial expressions; c. perform binomial multiplication by the FOIL method; d.
4.	4.

UNIFIED MATHEMATICS — YEAR TWO

Units and order of presentation	Corresponding Chapter, MATA*, Book 2
A. Logic	1
B. Groups	2
C. Angles	4
D. Quadrilaterals	6
E. Programming	14
F. Polynomials	(Book 1, first ed., Ch.9)
G. Similarity	7
H. Coordinates	8
I. Quadratic Equations	10
J. Probability	11
K. Transformations	12

Unit goals and teaching notes determine which portions of the text chapters are relevant. Resources outside the text are required especially for units A, D, and E. Optional units for future consideration or for advanced students are Locus (Ch. 9), and Congruent Triangles (Ch. 5).

* MATA is the abbreviation for Mathematics: A Topical Approach, the text for this curriculum.

The goals of this unit are for you to:	You know you're making progress when you can:
1. learn more about logical sentence structure and classification;	1.a. identify and write your own conjunctions and disjunctions; conditional statements, together with their converses, inverses, and contrapositives; bi-conditional statements; and quantified statements; b. negate the above types of statements, including the use of DeMorgan's Laws; c. construct truth tables for compound statements; d. translate English statements into logic notation, and vice-versa; e.
2. develop an understanding of proof as explanation according to rules;	2.a. solve cryptarithms; b. use rules derived from number facts to present your cryptarithm solutions in two-column proof format; c. set up an elimination table to solve cryptarithms; d. invent your own cryptarithm for someone else to solve; e.
3.	3.

The goals of this unit are for you to:	You know you're making progress when you can:
1. develop skill in performing modular ("clock") arithmetic;	1.a. perform additions and multiplications in any clock system up to Clock 11; b. figure out what hour (or day or month) it will be so many hours (or days or months) from now; c. check the correctness of any International Standard Book Number; d.
2. learn about the structure of a group;	2.a. draw an addition or multiplication table for any clock system up to Clock 11; b. identify inverse and identity elements from a clock system table; c. use inverses and identities to solve clock system equations; d. explain the four conditions for a group, and use them to test for a group; e. draw a piece of artwork based on a clock system table; f. report and ask sensible questions about the lives of Emmy Noether, Evariste Galois, George Boole, and Neils Abel; g.
3.	3.

UNIFIED MATH 2 UNIT ON ANGLES

The goals of this unit are for you to:	You know you're making progress when you can:
1. learn more about angles;	1.a. name the sum of the interior angles of a triangle or of any polygon; b. explain to a friend how to draw the exterior angle of a triangle and to calculate its value; c. make rough sketches illustrating the meanings of geometry vocabulary words (see below); d. use correctly the geometric symbols $\parallel$, $\cong$, $\triangle$, $\parallel_{gm}$, $\angle$, $\overline{\ }$, $\overrightarrow{\ }$, $\overleftrightarrow{\ }$, $\perp$; e.
2. develop your skill in geometric drawing and calculation;	2.a. draw and measure any size of angle with a protractor; b. calculate the measures of angles in diagrammed problems; c. bisect a line segment or an angle using a ruler and protractor; d. draw a geometric Navajo rug design based on acute and obtuse angles and parallel lines, using a protractor and ruler; e. construct a net for a polyhedron; f.
3.	3.

line, line segment, plane, point, collinear, coplanar, endpoint, ray, angle, adjacent angles, vertical angles, supplementary angles, complementary angles, corresponding angles, alternate angles, right angles, acute angles, obtuse angles, interior angles, exterior angles, congruent, midpoint, bisector, perpendicular, perpendicular bisector, parallel lines, transversal, polygon, triangle, quadrilateral, pentagon, hexagon, octagon, equilateral triangle, isosceles triangle, polyhedron, parallelogram, rectangle, square, trapezoid

UNIFIED MATH 2

UNIT ON QUADRILATERALS

The goals of this unit are for you to;

1. learn more facts about quadrilaterals;

2. develop your skill in doing constructions;

3.

You know you're making progress when you can:

1.a. test the truth values of statements about parallelograms, rectangles, rhombuses, and trapezoids;
b. calculate the sizes of line segments and angles from sketches of quadrilaterals;
c.

2.a. perform the six basic construction techniques plus construction of 90, 60, 45, and 30 degree angles;
b. construct a design by figuring out how it was made originally;
c. construct equilateral and isosceles triangles;
d. construct the medians and altitudes of any triangle;
e. construct the circumscribed and inscribed circles of any triangle;
f.

3.

The goals of this unit are for you to:	You know you're making progress when you can:
1. learn more about the TRS-80 microcomputer;	1.a. prepare a TRS-80 for programming; b. correctly use the names of various parts of the TRS-80 when operating it; c. show respect for the proper care and environment of the TRS-80; d.
2. develop your skill in programming the TRS-80 in BASIC;	2.a. use the RUN, LIST, and PRINT commands, plus the Break, Clear, Backspace/Erase, and Enter keys to load programs into the TRS-80; b. write programs which perform graphics tasks, and arithmetic and string functions; c. successfully use the following BASIC terms in your programs: CLS, PRINT, GOTO, IF-THEN, INPUT, SET, RESET, PRINT @, LET, END, READ, DATA; d. translate ordinary algebra into BASIC style, and vice-versa; e.
3. learn more about program and data storage;	3.a. save your programs on cassette tape and then re-play them into the TRS-80; b. load the library taped program of your choice into the TRS-80; c.
4.	4.

The goals of this unit are for you to:

1. develop your skill in handling polynomials;

2. learn more about some applications of quadratic polynomials;

3.

You know you're making progress when you can:

1.a. multiply monomials by monomials, binomials by binomials, and monomials by polynomials;
   b. play the Exponent Bingo game;
   c. perform binomial multiplications by the FOIL method;
   d. factor quadratic polynomials successfully;
   e.

2.a. use factors of quadratic polynomials to solve equations and problems;
   b.

3.

UNIFIED MATH 2

UNIT ON SIMILARITY

The goals of this unit are for you to:	You know you're making progress when you can:
1. develop your skill in calculating with ratios;	1.a. solve proportions by cross-multiplying; b. create new equal ratios from given equal ratios; c. calculate lengths of sides of similar polygons by the use of proportions; d.
2. learn more about the Pythagorean Theorem;	2.a. follow a proof of the Pythagorean Theorem which uses similar triangles; b. calculate lengths of sides of right triangles by means of the Pythagorean Theorem; c. create some Pythagorean triples of your own; d.
3.	3.

The goals of this unit are for you to:	You know you're making progress when you can:
1. develop your skill in graphing straight lines;	1.a. describe the x- and y-intercepts of any straight line; b. name the equation of a straight line by examining its graph; c. tell whether two lines are parallel, perpendicular, or neither, by inspecting their equations; d. change any linear equation in two variables into the form $y = mx + b$; e. solve systems of linear equations in two variables by graphing; f.
2. learn more about finding distances on graph paper;	2.a. use the Distance Formula correctly; b. locate the midpoint of a line segment on graph paper; c. calculate the costs of telephone calls based on the grid system; d. calculate the areas of shapes drawn on graph paper; e.
3.	3.

The goals of this unit are for you to:	You know you're making progress when you can:
1. develop your skill in solving quadratic equations;	1.a. write any quadratic equation in standard form; b. use factoring or the Quadratic Formula to solve any quadratic equation which has real roots; c.
2. learn more about graphs of quadratic functions;	2.a. make a table of values for a quadratic equation in two variables; b. identify the axis of symmetry and the turning point of a parabola you or a friend has graphed; c. use the axis of symmetry formula to assist you in graphing a parabola; d. solve a quadratic equation by graphing its associated parabola; e.
3. apply your learning to problems involving the force of gravity;	3.a. calculate the distances objects travel after being dropped or thrown; b. explain other forces besides gravity which affect falling objects; c.
4.	4.

UNIFIED MATH 2

UNIT ON PROBABILITY

The goals of this unit are for you to:	You know you're making progress when you can:
1. develop an understanding of the meaning of probability;	1.a. draw the outcome sets for tossing coins; throwing dice; taking multiple choice tests; choosing cards, letters, or marbles; having children; and dropping a thumbtack; b. calculate mathematical probabilities for some of the above situations, including use of the OR and the COUNTING principles; c. perform a test to obtain an experimental probability for some of the above situations; d. beat the STREET HUSTLER computer program; e.
2. find out more about permutations of different objects;	2.a. calculate the number of possible arrangements of letters of words, when all are different; b. calculate the possible number of telephone numbers for Farmington; c. calculate the possible number of car license plates for New Mexico; d. calculate the possible number of social security numbers for the United States; e. use permutations to calculate some mathematical probabilities; f.
3.	3.

The goals of this unit are for you to:	You know you're making progress when you can:
1. develop your skill in constructing transformation images;	1.a. draw exact reflection, rotation, and translation images on plain paper and on graph paper, using your ruler, compass, and protractor; b. recall and use correctly the coordinate rules for some common transformations; c. construct the results of the composition of transformations; d.
2. learn more about symmetry elements;	2.a. design symmetry for a word which normally has none; b. create a tessellation of the plane based on the square or equilateral triangle; c.
3. apply your skills to three-dimensions;	3.a. mentally fold and unfold paper; b. mentally rotate and reflect a cube; c.
4.	4.

Units and order of presentation	Corresponding Chapter, MATA*, Book 3
A. Rational Expressions	1
B. Radicals	2
C. Functions	3
D. Transformations	4
E. Exponents	5
F. Circles	6
G. Trigonometry	7
H. Programming	16
I. Solving Triangles	8
J. Tranformations	9
K. Matrices	13

Unit goals and teaching notes determine which portions of the text chapters are relevant. Optional units for future consideration or for advanced students are Probability (Ch. 10) and Sequences and Series (Ch. 12).

* MATA is the abbreviation for Mathematics: A Topical Approach, the text for this curriculum.

The goals of this unit are for you to:	You know you're making progress when you can:
1. develop skill in solving equations and inequations;	1.a. draw graphs of solution sets on number lines, including solution sets of absolute value problems; b. set up and solve equations from sports score situations; c. successfully solve algebra puzzles; d.
2. develop skill in handling algebraic fractions;	2.a. add, subtract, multiply, and divide simple algebraic fractions; b. write your own instructions for how to handle algebraic fractions; c.
3.	3.

UNIFIED MATH 3

UNIT ON RADICALS

The goals for this unit are for you to:	You know you're making progress when you can:
1. learn more about real number roots, radicals, and powers;	1.a. easily recall simple roots and powers of some small whole numbers; b. rationalize square root radical expressions; c. successfully work square root puzzles; d.
2. develop an understanding of "i" as a mathematical invention;	2.a. calculate the discriminant of a quadratic equation and explain the nature of the solutions; b. explain some facts about the lives and work of Giralamo Cardano and Roger Penrose; c.
3.	3.

The goals of this unit are for you to develop skill in:	You know you're making progress when you can:
1. handling function vocabulary and notation;	1.a. explain to a friend the meanings of the words relation, function, domain, range, mapping, and one-to-one; b. use the notation "f(x)" while calculating function values; c. produce the inverse of a simple function, if it exists; d. apply the vertical and horizontal line tests to the graph of any function; e. successfully handle the composition of two functions; f.
2. identifying types of functions;	2.a. identify from their equations or their graphs linear, quadratic, and absolute value functions; b. graph the above types of functions from their equations; c.
3.	3.

UNIFIED MATH 3

UNIT ON TRANSFORMATIONS

The goals of this unit are for you to:	You know you're making progress when you can:
1. develop greater skill in performing reflections, rotations, translations, and dilations;	1.a. use ruler, compass, and protractor to draw exact transformation images on plain and on graph paper; b. recall and use coordinate rules for transformations on graph paper; c.
2. develop a deeper understanding of symmetry;	2.a. create a decorative design which has three-fold rotational symmetry only; b. name the symmetry elements which characterize assorted tessellation patterns; c.
3. combine your knowledge of transformations with that of functions;	3.a. use function notation correctly when writing transformations; b. use these words correctly when describing transformations: domain, range, mapping, onto; c. draw the inverse function graph from a function's original graph; d.
4.	4.

UNIFIED MATH 3

UNIT ON EXPONENTS

The goals of this unit are for you to:	You know you're making progress when you can:
1. develop greater skill in handling various types of exponents;	1.a. simplify expressions that have zero and negative exponents; b. convert between radicals and fractional exponents; c.
2. develop skill in graphing exponential functions;	2.a. draw graphs of $y = b^x$, where $b > 0$ and $b \neq 1$; b. draw inverses of such graphs; c.
3. learn more about the concept of logarithm;	3.a. calculate logarithms to any positive base (except 1), especially to base 10; b. convert between logarithmic and exponential notation; c. solve simple logarithmic equations; d.
4. apply your knowledge to useful situations;	4.a. perform the calculations for carbon-14 dating as used in archaeology; b. calculate the growth of your bank savings by compound interest; c. calculate the growth of participants required in chain letter schemes; d.
5.	5.

UNIFIED MATH 3 UNIT ON CIRCLES

The goals of this unit are for you to:	You know you're making progress when you can:
1. learn more vocabulary for parts of circles;	1.a. draw rough sketches to illustrate the meanings of these words: chord, diameter, radius, circumference, semicircle, concentric circles, inscribed and circumscribed circles, major and minor arcs, segment, sector, tangent, and secant; b.
2. develop greater skill in calculating measures related to circles;	2.a. estimate the areas and circumferences of circles from their diameters; b. calculate lengths of arcs and areas of sectors and segments; c. calculate sizes of angles and lengths of lines drawn inside circles; d.
3. develop greater skill in constructions involving circles;	3.a. construct tangents to circles; b. construct inscribed and circumscribed circles for given triangles; c. figure out how to construct a given design based on circles; d.
4.	4.

The goals of this unit are for you to:	You know you're making progress when you can:
1. develop skill in converting between radian and degree measure;	1.a. explain to a friend the definition of a radian; b. use proportions to convert successfully between radians and degrees; c.
2. develop an understanding of sine, cosine, and tangent as functions related to the unit circle;	2.a. write down the sine, cosine, and tangent of an angle given its standard position on a graph of the unit circle; b. give the values of the sine, cosine, and tangent of 0, 30, 45, 60, and 90 degrees, and their multiples in any quadrant, by use of rotation and reflection; c. graph sine and cosine functions of real numbers, and state their amplitudes and periods; d.
3. develop appreciation for the applicability of sine wave oscillations;	3.a. discover and report on physical phenomena that can be modelled on sine wave oscillations; b.
4.	4.

UNIFIED MATH 3

UNIT ON PROGRAMMING

The goals of this unit are for you to:

1. develop greater skill in microcomputer operations;

2. develop skill in programming in BASIC;

3.

You know you're making progress when you can:

1.a. show respect for the proper care and environment of the TRS-80 microcomputer;
b. successfully use the Enter, Break, and Clear keys to operate the TRS-80;
c. use the commands NEW, LIST, RUN, CLOAD, and CSAVE to enter, load, run, and store programs;
d. use the commands LPRINT and LLIST to obtain program outputs and listings;
e.

2.a. translate algebraic and trigonometric statements into BASIC format, and vice-versa;
b. predict the output of simple programs by examining their listings and/or flowcharts;
c. write your own programs that use the statements CLS, PRINT, PRINT @, GOTO, IF-THEN, FOR-NEXT, DATA, READ, RND, COS, SIN, TAN, SQR, ABS, INT, LET, END, SET, RESET, and INPUT;
d.

3.

The goals of this unit are for you to:	You know you're making progress when you can:
1. develop skill in solving triangles;	1.a. locate any sine, cosine, and tangent, or their inverses, with a hand calculator, in degrees or in radians; b. use the Sine and Cosine Laws to solve any triangle; c.
2. apply your skills to right-angled triangles;	2.a. calculate the height of the school's flagpole, plus a height of your choice, by trigonometry; b.
3.	3.

The goals of this unit are for you to:	You know you're making progress when you can:
1. investigate further the nature of isometries;	1.a. recall the meanings of these terms and illustrate with rough sketches: isometry, direct isometry, opposite isometry, identity transformation, glide reflection; b. construct compositions of reflection, translation, rotation, and dilation on plain paper and on graph paper; c. break down any given isometry, by drawing, into (at most) three line reflections; d.
2. unify transformations and algebra;	2.a. perform symmetry transformations on plane figures; b. summarize the results of symmetry transformations in tables and test for group properties; c.
3.	3.

UNIFIED MATH 3

UNIT ON MATRICES

The goals of this unit are for you to:	You know you're making progress when you can:
1. learn about the construction of matrices;	1.a. name the order of any matrix; b. identify the elements of any matrix by means of subscript notation; c. write down the zero matrix of any order; d. show a friend the identity matrix for 2x2 matrix multiplication; e.
2. develop skill in matrix algebra;	2.a. multiply any matrix by a scalar; b. perform matrix multiplication with matrices of any order; c. find the inverses, both additive and multiplicative, of any 2x2 matrix; d. solve matrix equations; e. solve simultaneous equations in two variables by means of matrices; f. program the microcomputer to calculate the determinant and/or multiplicative inverse of a 2x2 matrix; g.
3. unify matrices and transformations;	3.a. discover some matrix representations for reflection, rotation, and dilation; b. use matrix representations to perform transformations on graph paper; c.
4.	4.